UNIVERSITY OF THE FRASER VALLEY

ORIGINAL COURSE IMPLEMENTATION DATE: September 2006
REVISED COURSE IMPLEMENTATION DATE: September 2020
COURSE TO BE REVIEWED (six years after UEC approval)**:** October 2020
Course outline form version: 05/18/2018

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: MATH 345	**Number of Credits:** 3 Course credit policy (105)
Course Full Title: Modern Geometries **Course Short Title:**	
Faculty: Faculty of Science	**Department (or program if no department):** Mathematics & Statistics

Calendar Description:

Euclidean and non-Euclidean geometries, such as projective geometry, spherical geometry, and hyperbolic geometry, including transformations, symmetries, and applications

Prerequisites (or NONE):	MATH 211, MATH 221, and MATH 265.
Corequisites (if applicable, or NONE):	NONE
Pre/corequisites (if applicable, or NONE):	NONE

Antirequisite Courses *(Cannot be taken for additional credit.)*
Former course code/number:
Cross-listed with:
Dual-listed with:
Equivalent course(s):
(If offered in the previous five years, antirequisite course(s) will be included in the calendar description as a note that students with credit for the antirequisite course(s) cannot take this course for further credit.)

Typical Structure of Instructional Hours

Lecture/seminar hours	50
Tutorials/workshops	
Supervised laboratory hours	
Experiential (field experience, practicum, internship, etc.)	
Supervised online activities	
Other contact hours:	
Total hours	**50**

Labs to be scheduled independent of lecture hours: ☐ No ☐ Yes

Special Topics *(Double-click on boxes to select.)*
This course is offered with different topics:
☒ No ☐ Yes *(If yes, topic will be recorded when offered.)*

Independent Study
If offered as an Independent Study course, this course may be repeated for further credit: *(If yes, topic will be recorded.)*
☐ No ☐ Yes, repeat(s) ☐ Yes, no limit

Transfer Credit
Transfer credit already exists: *(See **bctransferguide.ca**.)*
☐ No ☐ Yes
Submit outline for (re)articulation:
☒ No ☐ Yes *(If yes, fill in transfer credit form.)*

Grading System
☒ Letter Grades ☐ Credit/No Credit

Maximum enrolment (for information only): 36

Expected Frequency of Course Offerings:
alternate years *(Every semester, Fall only, annually, etc.)*

Department / Program Head or Director: Cynthia Loten	**Date approved:**	***June 18, 2019***
Faculty Council approval	**Date approved:**	October 4, 2019
Dean/Associate VP: Lucy Lee	**Date approved:**	October 4, 2019
Campus-Wide Consultation (CWC)	**Date of posting:**	November 8, 2019
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	November 22, 2019

Learning Outcomes:

Upon successful completion of this course, students will be able to:
1. Explain the foundations of Euclidean and at least 3 different non-Euclidean geometries – e.g., projective, hyperbolic, and spherical.
2. State precise definitions of fundamental concepts in the geometries studied.
3. Prove basic theorems in geometry.
4. Classify transformations and symmetries in different geometries.
5. Discuss properties of various transformations, including invariants.
6. Discuss the general notions of distance and geodesics, independent of any particular geometry.

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods *(Guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion.)*

The course will be primarily lecture-based.

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Text(s) and Resource Materials *(If more space is required, download Supplemental Texts and Resource Materials form.)*

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.	G.A. Jennings	Modern Geometry with Applications	☐	Springer-Verlag Universitext	1994
2.	J.N. Cederberg	A course in Modern Geometries	☐	Springer	2001
3.	P.J. Ryan	Euclidean And Non-Euclidean Geometry: An Analytic Approach	☐	Cambridge University Press	1996
4.	D.A. Brannan, M.F. Esplen, J.J. Gray	Geometry	☐	Cambridge University Press	2012
5.	Carroll and Rykken	Geometry: The Line and the Circle	☐	MMA Press	2018

Required Additional Supp

lies and Materials *(Software, hardware, tools, specialized clothing, etc.)*

Possible computer software: Geometer's Sketchpad, NonEuclid (freeware), Maple.

Typical Evaluation Methods and Weighting

Final exam:	40%	Assignments:	25%	Midterm exam:	35%	Portfolio:	%

Details (if necessary): Students must achieve at least 40% on the final exam in order to receive credit for this course

Typical Course Content and Topics

Euclidean geometry:
- n-dimensional Euclidean space
- Isometries: reflections, rotations, and translations
- The parallel postulate, angles, and the Pythagorean theorem
- Symmetries

Projective geometry:
- Projective coordinates
- Projective line, plane, and n-space
- Projective transformations
- Perspective drawing, Desargues' theorem
- Homogeneous polynomials, algebraic curves

Hyperbolic geometry:
- Parallels in hyperbolic geometry Area and angular defect
- Circles and distance Poincare's model
- Hyperbolic transformations

Spherical geometry:
- Geodesics on spheres
- Spherical triangles
- Spherical symmetries
- Application: mapmaking

Other geometries:
- Fractal geometry
- Spacetime geometry